PHYTOLOGIA

An international journal to expedite plant systematic, phytogeographical and ecological publication

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USE OF SEAWEEDS IN THE CONTROL OF ROOT ROT-ROOT KNOT DISEASE COMPLEX OF OKRA

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ABSTRACT

Stokeyia indica, Iyengaria stellata (brown), and *Solieria robusta* (red) seaweeds showed significant ($p<0.05$) control of root infecting fungi *viz., Macrophomina phaseolina, Rhizoctonia solani,* and *Fusarium solani* infection of okra roots. Use of *Stokeyia indica, Stoechospermum marginatum, I. stellata,* and *Solieria robusta* significantly ($p<0.05$) reduced gall formation on roots caused by *Meloidogyne javanica* root knot nematode. Maximum reduction was produced by *Stoechospermum marginatum* @ 1% w/w of soil. *Iyengaria stellata* used alone or with *Pseudomonas aeruginosa* plant growth promoting bacterium produced greater plant height.

KEY WORDS: seaweeds, algae, fungicide, nematicide, biocide

Exploitation of seaweed resources has attracted the attention of scientists all over the world because of their possible economic uses in various fields. Seaweeds contain all major and minor plant nutrients as well as biocontrol properties (Chapman & Chapman 1980; Shyamali *et al.* 1982). The wide varieties of marine algae have been found to possess useful biochemical compounds which have been studied as potential biocidal and pharmacological agents (Colwell 1983; Fenical 1982). Antimicrobial activity of seaweed has been reported (Febles *et al.* 1995; Hodgson 1984). Liquid concentration of brown seaweed *Ecklonia maxima* (Osbeck) Papenfuss significantly reduced root knot infestation and increased growth of tomato plants (Featomby-Smith & Staden 1983). Extract of *Ascophyllum nodosum* (Linnaeus) Le Jolis has been reported to reduce *Radopholus similis* infection on citrus (Tarjan 1977). Ara *et al.* (1997) also reported control of *Meloidogyne javanica* (Treub) Chitw. infection by *Sargassum* spp. on okra. *Pseudomonas aeruginosa* (Schroeter) Migula plant growth promoting bacterium (Izhar *et al.* 1995) is known to reduce root rot-root knot disease of chili (Siddiqui *et al.* 1999). Okra (*Abelmoschus esculentus* [L.] Moench), an important vegetable crop, is known to be attacked by root infecting fungi *viz.*,

Macrophomina phaseolina (Tassi) Goid, *Rhizoctonia solani* Kuhn, *Fusarium solani* (Mart) Appl. & Wollenw. emend. Snyd & Hans, and *F. oxysporum* Schlecht. emend. Snyd. & Hans (Ehteshamul-Haque & Ghaffar 1994) and root knot nematode (*Meloidogyne javanica*) (Maqbool 1992) in Pakistan. Experiments were therefore carried out to examine the effect of some brown and red seaweeds with or without *Pseudomonas aeruginosa* in the control of root rot-root knot disease complex of okra.

MATERIALS AND METHODS

Seaweeds viz., *Stoechospermum marginatum* (C. Agardh) Kutzing, *Stokeyia indica* Thivy & Dohshi, *Iyengaria stellata* (Borg) Borg (brown), and *Solieria robusta* (Greville) Kylin collected from Buleji, Karachi were washed, dried and powdered in an electric blender. Powdered seaweeds were mixed in sandy loam soil, pH 8.05 @ 0.5 and 1% w/w. The soil mixtures were transferred in 8 cm diameter plastic pots, 250 g per pot, which were watered daily and kept at 50% water holding capacity (Keen & Raczkowski 1921). The soil had a natural infestation of 4-13 sclerotia of *Macrophomina phaseolina* per gram of soil, as determined by wet sieving and dilution techniques (Sheikh & Ghaffar 1975), 5-12% colonization of *Rhizoctonia solani* on sorghum seeds used as baits (Wilhelm 1955) and 3300 cfu of mixed population of *Fusarium solani*, and *F. oxysporum* as assessed by the soil dilution technique of Nash & Snyder (1962). After three weeks, aqueous suspension of *Pseudomonas aeruginosa* (10^8 cfu/mi) multiplied on Nutrient Agar was drenched in each pot @ 25 ml/pot. Five seeds of okra (*Abelmoschus esculentus*) were sown in each pot. Each treatment was replicated four times and randomized on a screen house bench. Pots without seaweed or *P. aeruginosa* served as control. After germination four seedlings were left in each pot. One week old seedlings were inoculated with aqueous egg suspension of *Meloidogyne javanica* @ 2000 eggs/pot cultured on brinjal (*Solanum melongena* L.).

Plants were uprooted after six weeks growth and root knot index recorded on 0-5 scale (Taylor & Sasser 1978). Data on height and fresh shoot weight were also recorded. To determine the incidence of root infecting fungi, the method used by Short *et al.* (1980) was modified, in which roots were washed in running tap water, five 1 cm long root pieces from tap roots, surface disinfected with 1% $Ca(OCl)_2$ and placed onto Potato Dextrose Agar Plates containing penicillin (100000 units/liter) and streptomycin (0.2 g/liter). The dishes were incubated for 5 days and incidence of fungi were recorded. Data were analyzed and subjected to Factorial ANOVA (FANOVA), followed by Least Significant Difference (LSD) according to Gomez & Gomez (1984).

RESULTS

Use of *Stoechospermum marginatum*, *Stokeyia indica*, and *Solieria robusta* alone or with *Pseudomonas aeruginosa* significantly reduced gall formation on okra roots. Maximum reduction in gall formation (0.2) was produced by *Stoechospermum*

marginatum @ 1% followed by *Stokeyia indica* (0.5) as compared to untreated control (3.4) (Table 1).

Solieria robusta @ 1% showed complete control of *Macrophomina phaseolina* and *Rhizoctonia solani* infection on okra roots. Use of *Stoechospermum marginatum* and *Stokeyia indica* also produced significant (p<0.05) control of *M. phaseolina* infection. *Stokeyia indica* @ 0.5% used alone or where *Stokeyia indica* @ 0.5% and 1%, *Iyengaria stellata* @ 0.5% and *Solieria robusta* @ 1% were used with *Pseudomonas aeruginosa* produced complete control of *R. solani* infection. Use of *Stokeyia indica*, *I. stellata*, and *Solieria robusta* significantly reduced *Fusarium solani* infection (Table 2). Greater plant height was produced where *I. stellata* @ 1% was used alone or with *P. aeruginosa*. Maximum fresh weight of shoot was produced by *Stokeyia indica* used with *P. aeruginosa* (Table 1).

DISCUSSION

Seaweeds contain elaborate secondary metabolites that play a significant role in the defense of the host against predators and parasites which offers a potential novel approach to control populations of plant parasitic nematodes (Paracer *et al.* 1987). Growth inhibition of several bacteria and fungi by seaweed has been reported (Welch 1962). Febleo *et al.* (1995) reported antimicrobial activity of Canary species of Phaeophyta and Chlorophyta. Antimicrobial (Usmanghani & Shameel 1986) and cytotoxic activities (Ara *et al.* 1999) have been reported from Pakistan. Sheikh *et al.* (1990) isolated four diterpenoides from *Stoechospermum marginatum* which exhibited antibacterial and antifungal activities.

In the present study soil amendment with seaweeds significantly reduced *Macrophomina phaseolina*, *Rhizoctonia solani*, *Fusarium solani*, and *Meloidogyne javanica* infection on okra roots. There are reports that seaweed extract derived from *Ascophyllum nodosum* reduced the fecundity of the root knot nematode on tomato (Whapham *et al.* 1994). Soil amendment with *Sargassum* species significantly reduced infection of *Macrophomina phaseolina*, *R. solani*, and *F. solani* on sunflower (Ara *et al.* 1996). In the present study, in addition to reducing infection of root infecting fungi and root knot nematode, seaweeds also enhanced plant growth. The growth enhancement may be due to presence of growth regulators (Jeannin *et al.* 1991), like auxins, gibberellin and precursors of ethylene which have been detected in a number of seaweeds (Jolivet *et al.* 1991; Crouch *et al.* 1992) which improve vegetative and reproductive growth with an increase in seed production (Staden *et al.* 1994). Seaweeds could be exploited for the isolation of antifungal and nematicidal compounds for the control of root infecting fungi and nematodes affecting the vegetable crops.

Table 1. Effect of seaweeds on plant height, fresh weight of shoot and infection of *Meloidogyne javanica* on okra roots.

No.	Treatment	Plant height (cm)	Fresh shoot weight (g)	RKI
1.	Control	11.2	1.1	3.4
2.	*Pseudomonas aeruginosa* (Pa)	14.1	1.4	1.8
3.	*Stoechospermum marginatum* @ 0.5%	11.5	1.8	0.5
4.	*Stoechospermum marginatum* @ 1%	14.0	1.4	0.2
5.	*Stokeyia indica* @ 0.5%	13.9	2.0	0.5
6.	*Stokeyia indica* @ 1%	14.0	2.0	1.8
7.	*Iyengaria stellata* @ 0.5%	12.1	1.6	2.0
8.	*I. stellata* @ 1%	15.0	2.3	2.0
9.	*Solieria robusta* @ 0.5%	11.6	2.1	0.8
10.	*Solieria robusta* @ 1%	14.8	1.7	0.8
11.	*Stoechospermum marginatum* @ 0.5% +Pa	10.1	1.2	0.3
12.	*Stoechospermum marginatum* @ 1% +Pa	11.1	1.3	0.5
13.	*Stokeyia indica* @ 0.5% +Pa	12.5	2.8	1.2
14.	*Stokeyia indica* @ 1% +Pa	12.9	2.1	0.9
15.	*I. stellata* @ 0.5% +Pa	14.1	1.8	1.2
16.	*I. stellata* @ 1% +Pa	14.5	2.1	0.8
17.	*Solieria robusta* @ 0.5% +Pa	11.1	1.7	0.8
18.	*Solieria robusta* @ 1% +Pa	13.2	2.1	0.9
	$LSD_{0.05}$	2.6	1.0	1.2

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LITERATURE CITED

Ara, J., V. Sultana, S. Ehteshamul-Haque, R. Qasim, & V.U. Ahmad. 1999. Cytotoxic activity of marine macro-algae on *Artemia salina*. Phytother. Res. 13:304-307.

Table 2. Effect of seaweeds on infection of *Macrophomina phaseolina, Rhizoctonia solani,* and *Fusarium solani* on okra roots.

No.	Treatment	*M. phaseolina*	*R. solani*	*F. solani*
		infection %		
1.	Control	91	37	66
2.	*Pseudomonas aeruginosa* (Pa)	18	6	41
3.	*Stoechospermum marginatum* @ 0.5%	27	25	37
4.	*Stoechospermum marginatum* @ 1%	33	37	33
5.	*Stokeyia indica* @ 0.5%	27	0	18
6.	*Stokeyia indica* @ 1%	18	8	18
7.	*Iyengaria stellata* @ 0.5%	61	8	6
8.	*I. stellata* @ 1%	66	27	0
9.	*Solieria robusta* @ 0.5%	41	27	18
10.	*Solieria robusta* @ 1%	0	0	12
11.	*Stoechospermum marginatum* @ 0.5% +Pa	18	18	12
12.	*Stoechospermum marginatum* @ 1% +Pa	18	33	75
13.	*Stokeyia indica* @ 0.5% +Pa	50	0	33
14.	*Stokeyia indica* @ 1% +Pa	58	0	66
15.	*I. stellata* @ 0.5% +Pa	75	0	61
16.	*I. stellata* @ 1% +Pa	18	6	6
17.	*Solieria robusta* @ 0.5% +Pa	50	18	41
18.	*Solieria robusta* @ 1% +Pa	71	0	61
	$LSD_{0.05}$ Treatments = 26.8			
	$LSD_{0.05}$ Pathogens = 10.9			

Ara, J., S. Ehteshamul-Haque, V. Sultana, A. Ghaffar, & R. Qasim. 1997. Use of *Sargassum* species for the control of *Meloidogyne javanica* in okra. Nematol. Medit. 25:125-128.

Ara, J., S. Ehteshamul-Haque, V. Sultana, R. Qasim, & A. Ghaffar. 1996. Effect of *Sargassum* seaweed and microbial antagonists in the control of root rot disease of sunflower. Pak. J. Bot. 28:221-226.

Chapman, V.J. & D.J. Chapman. 1980. *Seaweed and Their Uses*, 3rd. ed. Chapman and Hall, New York, New York. 334 pp.

Colwell, R.R. 1983. Biotechnology in marine science. Science 222:1924.

Crouch, I.J., M.T. Smith, V.J. Staden, M.J. Lewis, G.V. Hoad, & V.J. Staden. 1992. Identification of auxins in a commercial seaweed concentrate. J. Plant Physiol. 139:590-594.

Ehteshamul-Haque, S. & A. Ghaffar. 1994. New records of root infecting fungi from Pakistan. Pak. J. Phytopath. 6:50-57.

Featomby-Smith, B.C. & V. Standen. 1983. The effect of seaweed concentration on the growth of tomato plants in nematode infested soil. Scientia Horticulture 20:137-146.

Febles, C.I., A. Arias, A. Hardisson, & A.S. Lopez. 1995. Antimicrobial activity of extracts from Canary species of Phaeophyta and Chlorophyta. Phytotherapy Res. 9:385-387.

Fenical, W. 1982. Natural products chemistry in the marine environment. Science 215:923-928.

Gomez, K.A. & A.A. Gomez. 1984. *Statistical Procedures for Agricultural Research*. 2nd ed. Wiley & Sons, New York, New York. 680 pp.

Hodgson, L.M. 1984. Antimicrobial and antineoplastic activity in some South Florida seaweeds. Botanica Marina 27:387-390.

Izhar, I., S. Ehteshamul-Haque, M. Javeed, & A. Ghaffar. 1995. Efficacy of *Pseudomonas aeruginosa* and *Bradyrhizobium* species in the control of root rot disease in chickpea. Pak. J. Bot. 27:451-455.

Jeannin, I., J.C. Lescure, & J.F. Gaudry. 1991. The effect of aqueous seaweed sprays on the growth of maize. Botanica Marina 34:469-473.

Jolivet, E., I. De Langlais-Jeannin, J. Moroto-Gaudry, & De Langlais-Jeannin. 1991. Extracts of marine algae. Phytoactive properties and agronomic value. Annee-Biologique 30:109-126.

Keen, B.A. & H. Raczkowski. 1921. The relation between clay content and certain physical properties of soil. J. Agric. Sci. 11:441-449.

Maqbool, M. 1992. Distribution and host association of plant parasitic nematodes in Pakistan. NNRC. University of Karachi, Karachi-75270, Pakistan.

Nash, S.M. & W.C. Snyder. 1962. Quantitative estimation by plate counts of propagules of the bean root rot *Fusarium* in field soils. Phytopath. 52:567-572.

Paracer, S., C. Armin, A.C. Tarjan, & L.M. Hodgson. 1987. Effective use of marine algal products in the management of plant parasitic nematodes. J. Nematol. 19:194-200.

Shaikh, W., M. Shameel, A. Hayee-Memon, K. Usmanghani, S. Bano, & U.V. Ahmad. 1990. Isolation and characterization of chemical constituents of *Stoechospermum marginatum* (Dictyotales, Phaeophyta) and their antimicrobial activity. Pak. J. Pharm. Sci. 3:1-9.

Sheikh, A.H. & A. Ghaffar. 1975. Population study of sclerotia of *Macrophomina phaseolina* in cotton fields. Pak. J. Bot. 7:13-17.

Short, G.E., T.D. Wyllie, & P.R. Bristow. 1980. Survival of *Macrophomina phaseolina* in soil and in residue of soybean. Phytopath. 70:13-17.

Shyamali, S.M., De Silva, S.K.T. Gamage, & N.S. Kumar. 1982. Anti-bacterial activity of extracts from the brown seaweed *Stoechospermum marginatum*. Phytochemistry 21:944-945.

Siddiqui, I.A., S. Ehteshamul-Haque, & A. Ghaffar. 1999. Root dip treatment with *Pseudomonas aeruginosa* and *Trichoderma* spp., in the control of root rot-root knot disease complex in chili (*Capsicum annuum* L.). Pak. J. Nematol. 17:67-75.

Staden J.V., S.J. Upfold, F.E. Drewes, & J.V. Staden. 1994. Effect of seaweed concentrate on growth and development of the marigold *Tagetes patula*. J. Applied Phycology 6:427-428.

Tarjan, A.C. 1977. Kelp derivatives for nematode infected citrus trees. J. Nematol. 9:287 (Abstr.)

Taylor A.L. & J.N. Sasser. 1978. *Biology, Identification of Root-knot Nematodes* (*Meloidogyne* species). Graphics, USA, North Carolina State University, Raleigh, North Carolina. 111 pp.

Usmanghani, K. & M. Shameel. 1986. Studies on the antimicrobial activity of certain seaweeds from Karachi coast. *In*: pp. 519-526. *Prospects for Biosaline Research,* Proc. US-Pak Biosaline Res. Workshop. R. Ahmad & A. San Pietro (eds.). Department of Botany, University of Karachi, Karachi-75270, Pakistan.

Welch, A.M. 1962. Preliminary survey of fungistatic properties of marine algae. J. Bacteriol. 83:97-99.

Whapham C.A., T. Jenkins, G. Blunden, & S.D. Hankins. 1994. The role of seaweed extract, *Ascophyllum nodosum* in the reduction of fecundity of *Meloidogyne javanica*. Appl. Fund. Nematol. 17:181-183.

Wilhelm, S. 1955. Longevity of the *Verticillium* wilt fungus in the laboratory and field. Phytopath. 45:80-181.

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ADDITIONAL POPULATIONS OF *ARCEUTHOBIUM HONDURENSE* DISCOVERED IN HONDURAS

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ABSTRACT

Additional locations are documented for *Arceuthobium hondurense*. The species is as yet known only from Honduras.

KEY WORDS: *Arceuthobium*, Viscaceae, Honduras

In March 1999, Honduran dwarf mistletoe (*Arceuthobium hondurense* Hawksw. & Wiens) was observed parasitizing *Pinus oocarpa* Schiede 5 km east of Lepaterique, Department Francisco Morazán, Honduras (1950 m elevation) along the main road to Tegucigalpa. Honduran dwarf mistletoe is one of the rarest dwarf mistletoes in the New World (Hawksworth & Wiens 1996), and this is only the third confirmed location for this dwarf mistletoe. Several trees were severely infected at the Lepaterique location. Infected trees had branch swellings, abundant aerial shoots, and many produced witches' brooms. Anthesis for this mistletoe was thought to occur only in August-September (Hawksworth & Wiens 1996; Mathiasen *et al.* 1998), but we found male plants were at peak flowering in early March. Therefore, this mistletoe appears to have two distinct flowering periods annually: February-March and August-September. Specimens of *A. hondurense* from near Lepaterique were collected and have been deposited at the Deaver Herbarium (ASC), Northern Arizona University, Flagstaff, AZ. Our examination of three herbarium specimens of *A. hondurense* deposited at the Standley Herbarium (EAP), Escuela Agricola Panamericana, Zamorano, Honduras indicates that this mistletoe also occurs in Celaque National Park west of Gracias, Department Lempira, in western Honduras. Therefore, there are now four known, widely isolated geographic areas (Figure 1) where this rare dwarf

Figure 1. Location of the only known populations of *Arceuthobium hondurense* in Honduras: Cusuco National Park (circle), in the Piedra Herrada Mountains southeast of Tegucigalpa (star), near Lepaterique (diamond), and in Celaque National Park (triangle).

mistletoe occurs in Honduras: 1 - west of Zamorano (four collected populations), 2 - Cusuco National Park (one collected population), 3 - east of Lepaterique (one collected population), and 4 - Celaque National Park (three collected populations) (Figure 1). The reasons for the occurrence of this dwarf mistletoe in extremely disjunct populations (> 40 km apart) within a landscape of almost continuous forests of its principal host remain unknown (Hawksworth & Wiens 1996). We speculate that because most of these pine forests consist of second-growth stands, many populations of *A. hondurense* that once existed have been eliminated by the large-scale harvesting of Honduran forests.

LITERATURE CITED

Hawksworth, F.G. & D. Wiens. 1996. Dwarf Mistletoes: Biology, Pathology, and Systematics. USDA Agric. Handb. 709, 410 pp.

Mathiasen, R.L., C.G. Parks, B.W. Geils, & J.S. Beatty. 1998. Notes on the distribution, host range, plant size, phenology, and sex ratio of two rare dwarf mistletoes from Central America: *Arceuthobium hawksworthii* and *A. hondurense*. Phytologia 84:154-164.

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SOLANUM ORTEGAE, A NEW PERUVIAN SPECIES FROM SECT. *PETOTA*

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ABSTRACT

A new species of *Solanum* sect. *Petota* is described as *S. ortegae*. The species is known from Apurímac, Perú. In addition, a correction is made to a previous publication.

KEY WORDS: *Solanum* sect. *Petota*, Solanaceae, taxonomy

The monographic work entitled *Las Papas de Sudamérica: Perú* (Ochoa 1999) was recently published. On page 482 of this work, the type locality of *Solanum yamobambense* Ochoa (*Ochoa 1431*) is cited as located in the Department of Cajamarca. However, the correct citation is Department of La Libertad, province Otuzco, above Yamobamba, as it is cited in the original diagnosis. The correct citation is also found on page 484 of *Las Papas de Sudamérica: Perú*.

Recently, while preparing my personal herbarium to be donated to a Public Institution, I found some interesting and unpublished collections, including the species described here.

Solanum ortegae C.M. Ochoa, *spec. nov.* TYPE: PERU. Dept. Apurímac, prov. Grau, Mollebamba, 2600 m alt., n.v. *Alkko Papa*, March 1973, col. *C. Ochoa 4094* (HOLOTYPE: USM; Isotypes: CPNU,CUZ,MOL).

Plantae robuste, 40-60 cm altae, sparse brevitesque pilosae, caule erecti ramosi, stolonifera et tubifera. Tuberculi subalbidus vel bruneolus, globosi usque ovatus, grossus, 6-7 cm longus. Folia imparipinnata, magnus 18.5-25.0 cm × 11.5-17.0 cm, 2-3 paribus foliolis et 0-1 paribus interjectis foliolorum. Foliolum terminale manifeste majus, 5.5-12.0 cm × 2.5-6.5 cm, ovatus, apice acutum vel subacutum, basim subcuneata; foliolo lateralia subsessilia vel breviter petiolulata apice obtusa vel subacuta, basim conspicuus asymmetricus. Pedunculus 10-12 cm longus, 1.5-2.0 mm diam., basim puberulus; pedicellus 25-30 cm longus, articulati 8-9 mm infra calyce. Calyci

asymmetrici, 12-15 mm longi. Corollae violaceus, rotatus, magnus 4 cm diam. Antherae 7 mm longae. Stylus 11 mm longus. Baccae globosae vel subglobosae, 2.0-2.5 cm diam. Numerus cromosomatus: $2n=2x=24$.

Ad Ing. Agr. Rammiro Ortega, discipulo meo, cum gaudio hanc speciem dedico.

Plants robust, 40-60 cm tall, stems erect, branched, stoloniferous and tuberiferous, narrowly winged, straight wings. Tubers white-grayish to light brown, globose to oval, thick, 3-4(-6) cm long. Imparipinnate leaves, 18.5-25.0 cm long by 11.5-17.5 cm wide, short and sparsely pilose with 2-3 pairs of lateral leaflets and 0-1 pair of interjected leaflets; terminal leaflet ovate to ovate-elliptic, larger and wider than the laterals, 5.5-12.0 cm long by 2.5-6.5 cm wide, apex pointed to subacuminate, base cuneate to subcuneate; first upper pair of lateral leaflets 4-10 cm long and 1-4 cm wide, apex obtuse to subpointed, base conspicuously asymmetrical, subsessile or slightly decurrent on the rachis, second and third pairs of the lower leaflets about the same size or decreasing slightly toward the base. Pseudostipular leaves asymmetric, narrowly elliptic-lanceolate to subfalcate, 8-12(-15) mm long by 5-7 mm wide. Inflorescence cymose. Peduncle 10-12 cm long by 1.5-2.0 mm in diam at base, puberulent as are the pedicels and calyx; pedicels 25-30 mm long and 0.5-0.7 mm in diam, articulated at 8-9 mm below calyx. Calyx asymmetrical, 10-12 mm long, lobes narrowly lanceolate, attenuate toward the apex or narrowed in acute acumens of 4-5 mm long. Corolla violet, rotate, 3.5-4.0 cm in diam. Anthers narrowly lanceolate, 6.5-7.0 mm long; filaments 2.0-2.5 mm long. Style 10.5-11.5 mm long; stigma broadly capitate, cleft. Fruits globose to subglobose, 2.0-2.5 cm long, pale green with scattered white dots, not verrucose. Chromosome number, $2n=24$. Propose abbreviation here for this species: *ort.*

Affinities: *Solanum ortegae* has some affinity with *S. velardei* Ochoa by the leaf dissection. However, the two species are different in the shape and disposition of the leaflets, in the position of the pedicel articulation, in the calyx shape and size, and in the corolla color.

LITERATURE CITED

Ochoa, C.M. 1999. *Las Papas de Sudamérica: Perú.* Allen Press, Lawrence, Kansas.

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THALICTRUM THALICTROIDES (L.) EAMES & BOIVIN (RANUNCULACEAE): NEW TO TEXAS

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ABSTRACT

Thalictrum thalictroides is reported as new to Texas. A key to species of the genus occurring in northeast Texas is included.

KEY WORDS: *Thalictrum*, Ranunculaceae, Texas

Thalictrum thalictroides Eames & Boivin, rue anemone or windflower, is an erect, slender, glabrous perennial herb 1-2 dm high that grows from a small cluster of fusiform tubers. Basal leaves are biternately compound while the few-flowered umbel is subtended by 2 or 3 opposite or whorled, sessile, ternately compound involucral leaves. The 5-10 sepals are petaloid, 10-15 mm long, and white to pale pink-purple in color. Pistils number 8-12. The achenes are fusiform, saliently several-ribbed, and tipped with the persistent, sessile, capitate stigmas (Gleason & Cronquist 1963). Some botanists still place this taxon in the segregate genus *Anemonella*, which is based solely upon its umbellate inflorescence. The other species of *Thalictrum* from the United States have inflorescences that are panicles, racemes, or corymbs (Park & Festerling 1997).

Thalictrum thalictroides is widely distributed in eastern United States and is also known from Ontario, Canada (Park & Festerling 1997). In states adjacent to Texas, the species is known to occur in the Gulf Coastal Plain Region of Choctaw and McCurtain counties in southeast Oklahoma (Paul Kores, pers. comm.). It has also been documented from the Gulf Coastal Plain Region of southwest Arkansas in Miller County (Smith 1988), just east of Bowie County, Texas. The following collections from Lamar and Red River counties in Texas extend the distribution of *T. thalictroides*

southward approximately 20 km from its nearest documented station in Choctaw County, Oklahoma, but, more importantly, constitute the first report of this species from Texas.

Specimens Cited: TEXAS. Lamar Co.: 1.2 miles north of Pinhook Community, S side of Little Pine Creek, 17 Apr 1999, *Singhurst 7739* (BAYLU). Red River Co.: 2.3 miles northwest of Manchester, S side of Big Pine Creek, 0.7 miles SW of Flag Pond, 15 Apr 1999, *Singhurst 7737 & Berry* (BAYLU); same location (fruiting material), 13 May 1999, *Holmes 10025 & Singhurst* (BAYLU); Tanyard Creek, 1.6 miles NW of Woodland, 17 April 1999, *Singhurst 7738* (BAYLU); same location (fruiting material), 13 May 1999, *Holmes 10072 & Singhurst* (BAYLU).

Thalictrum thalictroides occurs in mature hardwood forests on very steep (8-20%) slopes in moist soils with a rich humus layer. Common overstory trees include *Quercus alba* L., *Q. shumardii* Buckl., and *Q. muhlenbergii* Engelm. (Fagaceae), and *Ulmus rubra* Muhl. (Ulmaceae). Subcanopy plants include *Cornus florida* L. and *Cornus drummondii* C.A. Mey. (Cornaceae), *Sassafras albidum* (Nutt.) Nees. (Lauraceae), *Vaccinium stamineum* L. (Ericaceae), *Callicarpa americana* L. (Verbenaceae), and *Smilax* spp. (Smilacaceae). Associated herbaceous flora consists of *Agrimonia rostellata* Wallr. (Rosaceae), *Botrychium virginianum* (L.) Sw. (Ophioglossaceae), *Carex* spp. (Cyperaceae), *Desmodium* spp. (Leguminosae), *Podophyllum peltatum* L. (Berberidaceae), *Polystichum acrostichoides* (Michx.) Schott. (Dryopteridaceae), *Sanicula canadense* L. (Umbelliferae), *Senecio* sp. and *Solidago* sp. (Compositae).

Until this report, only two other species of *Thalictrum* were known to occur in northeast Texas, *T. arkansanum* Eames & Boivin and *T. dasycarpum* (Fisch.) Mey. & Ave-Lall. The three species may be distinguished by use of the following key, which is modified from Waterfall (1966) and Smith (1988).

1. Inflorescence umbellate; flowers perfect, sepals 5-10, white to pinkish, 5-18 mm long, persistent, stigmas capitate; plants 1-2 dm tall.................... *T. thalictroides*
1. Inflorescence paniculate; flowers mostly imperfect, sepals 4-5, greenish to purplish, 1-4 mm long, caducous, stigmas elongate; plants 2-20 dm tall............2
    2. Middle and upper leaves petiolate; carpels 2-9 per flower; plant decumbent, ca. 2-4 dm long; lower surfaces of leaves glabrous.................... *T. arkansanum*
    2. Middle and upper leaves sessile; carpels 9-15 per flower; plant erect, ca. 2 m tall, lower surfaces of the leaflets usually pubescent.............. *T. dasycarpum*

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LITERATURE CITED

Gleason H.A. & A. Cronquist. 1963. *Manual of the Vascular Plants of Northeastern United States and Adjacent Canada*. D. Van Nostrand Co., Princeton, New Jersey.

Park, M.M. & D. Festerling, Jr. 1997. *Thalictrum* in: *Flora of North America Editorial Committee, Flora of North America North of Mexico 3. Magnoliophyta: Magnoliidae and Hamamelidae*. Oxford University Press, New York, New York. pp. 258-271.

Smith, E.B. 1988. *An Atlas and Annotated List of the Vascular Plants of Arkansas*, 2nd ed. Published by the author. Fayetteville, Arkansas.

Waterfall, U.T. 1966. *Keys to the Flora of Oklahoma*. Oklahoma State University, Stillwater, Oklahoma.

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FULL CONSTITUTION OF THE AUSTRALIAN GENUS *PAPPOCHROMA* (ASTERACEAE: ASTEREAE)

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ABSTRACT

The observation by Forbes & Morris (1996) that the Australian taxa *Pappochroma* Raf. and *Lagenithrix* Nesom are part of a single phylad is reasonable and their taxonomic revision of the group provides needed clarification. Treatment of these nine species within the subtribe Lageniferinae, however, is a more realistic assessment of their morphology and relationships than their placement within the genus *Erigeron* (Conyzinae). This group is consolidated here within *Pappochroma*, requiring new combinations as follows: ***P. bellidioides*** (Hook. *f.*) Nesom, *comb. nov.*, ***P. nitidum*** (S.J. Forbes) Nesom, *comb. nov.*, ***P. paludicola*** (S.J. Forbes) Nesom, *comb. nov.*, ***P. gunnii*** (Hook. *f.*) Nesom, *comb. nov.*, ***P. setosum*** (Benth.) Nesom, *comb. nov.*, ***P. stellatum*** (Hook. *f.*) Nesom, *comb. nov.*, and ***P. trigonum*** (S.J. Forbes & D.I. Morris) Nesom, *comb. nov.*

KEY WORDS: *Pappochroma*, *Lagenithrix*, *Erigeron*, Asteraceae, Astereae, taxonomy, nomenclature, Australia

In an earlier study (Nesom 1994a), a group of Australian species of *Erigeron* was placed into two separate genera, both of which I hypothesized to be more closely related to *Lagenifera* and other genera placed within the Lageniferinae (*sensu* Nesom 1994b). I observed (1994a, p. 155) that "Within the domain of relationship of the pappose species here placed in *Lagenopappus* and *Lagenithrix*, it might appear that only a single genus is represented." Based on my limited sampling, however, I was not able to conclude that the two groups were most closely related to each other. I further noted that several undescribed taxa existed in the *Erigeron pappocromus* Labill. group (*Lagenopappus*) and treated it tentatively "without the direction of a much-needed revision of this complex," merely referring to the entities informally pointed out by earlier researchers (*e.g.*, Gray *in* Costin *et al.* 1979; Jacobs & Pickard 1981; Porteners 1992) and noting that nomenclatural modifications would be required as this group was studied. It was quickly recognized that Rafinesque's "*Pappochroma*" was the correct name for the group I segregated as *Lagenopappus* (Nesom 1994c). Forbes & Morris (1996) have since provided the taxonomic revision of this species complex

and emphasized that the taxa I separated at generic rank are indeed but points along a "clear gradation in the series of species" (p. 176) within a single monophyletic group, which they maintained within *Erigeron*, adding three species without previous formal description. Based on their field experience and first-hand knowledge of the Australian plants, their presentation of the species delimitations and argument for the coherence of the group is convincing. On the other hand, the primary thrust of my 1994 discussion, as I tried to convey, was that these species do not belong in *Erigeron* or even the subtribe Conyzinae (sensu Nesom 1994b, with modifications suggested by Noyes, in press).

The Australian species considered here differ from *Erigeron* and all Conyzinae in their achenes with a tendency to produce a narrowed apex with viscid, sessile, caducous, or persistent glands. Forbes & Morris noted that "the thickened apical collar" that I described "is rather illusory and certainly not comparable to that of *Lagenifera*." The glandular achene apex, sometimes observed as an apical collar, of these Australian species is not identical to that of *Lagenifera* but the resemblance is more than an illusion. My observation was (and remains) that the achene apex of these species clearly is comparable to the glandular achene apex of *Lagenifera*. More precisely, in view of the similarity of these species to Lageniferinae in habit and other features (as discussed in detail in Nesom 1994a), as well as their obvious geographic proximity, the achenes appear to be homologous in this aspect of their morphology.

A characteristic feature of Conyzinae is the presence of conspicuous orange resin ducts along the veins of phyllaries, disc corollas, and achenes. These structures are uncommon elsewhere in the Astereae, and they apparently do not occur in Lageniferinae. The Australian plants considered here do not produce orange resin ducts, and in view of the consistency with which such structures occur in Conyzinae, I consider this further evidence for treating *Pappochroma* as a genus unrelated to *Erigeron*. As I noted earlier, were it not for production of a pappus of persistent barbellate bristles and relatively conspicuously ligulate ray flowers, both features plesiomorphic and generalized across the whole of Astereae, I believe the similarity of these plants to *Lagenifera* and related genera surely would have been recognized before now.

A nomenclatural summary is provided here, consolidating the species within *Pappochroma*. Full synonymy is given in Forbes & Morris (1996).

Pappochroma Raf., *Fl. Tellur.* 2:48. 1836 [1837].
Lagenithrix Nesom, Phytologia 76:148. 1994.
Lagenopappus Nesom, Phytologia 76:153. 1994.

1. ***Pappochroma bellidioides*** (Hook. *f.*) Nesom, *comb. nov.*
[*H*]*Aplopappus bellidioides* Hook. *f.*, Hooker's London J. Bot. 6:112. 1847.
Erigeron bellidioides (Hook. *f.*) S.J. Forbes & D.I. Morris, Muelleria 9:183. 1996.

2. *Pappochroma gunnii* (Hook. *f.*) Nesom, Phytologia 76:426. 1994.
   [H]Aplopappus gunnii Hook. *f.*, Hooker's London J. Bot. 6:111. 1847.
   Erigeron gunnii (Hook. *f.*) F. Muell. *ex* Hook. *f.*, *Fl. Tasman.* 1:183. 1856.
   Lagenopappus gunnii (Hook. *f.*) Nesom, Phytologia 76:154. 1994.

3. ***Pappochroma nitidum*** (S.J. Forbes) Nesom, *comb. nov.*
   Erigeron nitidus S.J. Forbes, Muelleria 9:181. 1996.

4. ***Pappochroma pappocromum*** (Labill.) Nesom, *comb. nov.*
   Erigeron pappocromus Labill., *Nov. Holl. Pl.* 2:47 t. 193. 1806.
   Pappochroma uniflorum (as "*uniflora*") Raf., *Fl. Tellur.* 2:48. 1836 [1837].
   Lagenopappus pappocromus (Labill.) Nesom, Phytologia 76:154. 1994.

   Rafinesque treated the generic name *Pappochroma* as feminine, using the epithet "*uniflora*." I accept the view (as noted by Paul Wilson, *fide* Forbes & Morris) that because the Greek "*chroma*" is neuter in gender, and that because the slight difference in spelling skirts the illegitimacy of tautonymy, the correct name should be as the combination provided above.

5. ***Pappochroma paludicola*** (S.J. Forbes) Nesom, *comb. nov.*
   Erigeron paludicola S.J. Forbes, Muelleria 9:178. 1996.

6. ***Pappochroma setosum*** (Benth.) Nesom, *comb. nov.*
   Erigeron pappocromus Labill. var. *setosus* Benth., *Fl. Austral.* 3:494. 1867.
   Erigeron setosus (Benth.) M. Gray, Contr. Herb. Austr. 6:1. 1974.
   Lagenithrix setosa (Benth.) Nesom, Phytologia 76:150. 1994.

7. ***Pappochroma stellatum*** (Hook. *f.*) Nesom, *comb. nov.*
   [H]Aplopappus stellatus Hook. *f.*, Hooker's London J. Bot. 6:112. 1847.
   Erigeron stellatus (Hook. *f.*) W.M. Curtis, *Students Fl. Tasman.* Pt. 2:463. 1856.
   Lagenithrix stellata (Hook. *f.*) Nesom, Phytologia 76:151. 1994.

   Forbes & Morris (p. 176) note that "fertility of the florets is difficult to establish as mature achenes are rarely produced." My observation that *Pappochroma stellatum* has functionally staminate disc flowers (with sterile ovaries) was based on its production of disc style branches without stigmatic lines, an absolutely consistent concomitant of ovarian sterility in various genera of Astereae.

8. *Pappochroma tasmanicum* (Hook. *f.*) Nesom, Phytologia 76:426. 1994.
   [H]Aplopappus tasmanicus Hook. *f.*, Hooker's London J. Bot. 6:110. 1847.
   Erigeron tasmanicus (Hook. *f.*) Hook. *f.*, *Fl. Tasman.* 1:183, t. 46A. 1856.
   Lagenopappus tasmanicus (Hook. *f.*) Nesom, Phytologia 76:154. 1994.

9. ***Pappochroma trigonum*** (S.J. Forbes & D.J. Morris) Nesom, *comb. nov.* *Erigeron trigonus* S.J. Forbes & D.I. Morris, Muelleria 9:187. 1996.

Forbes & Morris expressed concern about the identity of "the alpine New Guinean *Erigeron* species recognized by Van Royen (1983)," apparently in the same context as the evaluation of the generic identity of the Australian species. The two species described and illustrated by Van Royen, *E. sumatrensis* Retz and *E. canadensis* L., are cosmopolitan weeds generally treated as *Conyza* and are bonafide members of the Conyzinae.

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LITERATURE CITED

Costin, A.B., M. Gray, C.J. Totterdell, & D.J. Wimbush. 1979. *Kosciusko Alpine Flora*. Commonwealth Scientific and Industrial Research Organization (CSIRO), East Melbourne, Australia.

Forbes, S.J. & D.I. Morris. 1996. A review of the *Erigeron pappocromus* Labill. complex. Muelleria 9:175-189.

Jacobs, S.W.L. & J. Pickard. 1981. *Plants of New South Wales: A Census of the Cycads, Conifers and Angiosperms*. Royal Botanic Gardens, Sydney, Australia.

Nesom, G.L. 1994a. Taxonomic dispersal of Australian *Erigeron* (Asteraceae: Astereae). Phytologia 76:143-159.

Nesom, G.L. 1994b. Subtribal classification of the Astereae (Asteraceae). Phytologia 76:193-274.

Nesom, G.L. 1994c. *Pappochroma* Rafin. is the correct generic name for *Erigeron pappocromus* Labill. Phytologia 76:426.

Noyes, R.D. In press. Biogeographical and evolutionary insights on *Erigeron* and allies (Asteraceae) from ITS sequence data. Pl. Syst. Evol.

Porteners, M.F. 1992. *Erigeron*. Pp. 175-177. *In*: G.J. Harden (ed.), *Flora of New South Wales*, vol. 3. New South Wales University Press, Kensington, Australia.

Van Royen, P. 1983. *The Alpine Flora of New Guinea*, vol. 4, Taxonomic part, Casuarinaceae to Asteraceae. J. Cramer, Vaduz, Lichtenstein.

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PHLOX DRUMMONDII (POLEMONIACEAE) REVISITED

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ABSTRACT

A taxonomic overview of the *Phlox drummondii* complex is presented, this after a biosystematic study of the group that appeared in 1962. Over the intervening 37 year period, I have examined numerous field populations of the taxa concerned, and studied anew the large assemblage of collections at LL, TEX, including numerous new acquisitions. Contrary to my original study which treated the *P. drummondii* complex as composed of six varieties distributed among two subspecies, I now treat the group as composed of but five varieties; all of these intergrade to some, often considerable, extent near regions of overlap or close contact, and none appears deserving of subspecific status. The taxa recognized are: var. *drummondii* (including var. *goldsmithii* and var. *wilcoxiana*); var. *johnstonii*, newly described since my initial treatment; var. *littoralis* (including var. *glabriflora*); var. *peregrina* (a horticultural variant introduced by wildflower enthusiasts and persisting along roadsides); var. *mcallisteri*; and var. *tharpii*. Distribution maps of the taxa are provided and one new combination, ***P. drummondii*** var. ***johnstonii*** (Wherry) B.L. Turner, *stat. nov.*, proved necessary.

KEY WORDS: *Phlox drummondii*, Polemoniaceae, taxonomy, nomenclature

INTRODUCTION

Phlox drummondii is a common garden annual, having been taken into cultivation in the early part of the 19th century from seed collected in south-central Texas by Drummond, these delivered to KEW where they were grown (Kelly 1915). The original description (published with a colored plate) was mostly made from garden grown material. Subsequent collections by numerous workers revealed a wide array of populational variants in central Texas, their presence first called to the fore (in a revisional sense) by Brand (1907), this expanded upon by Whitehouse (1945), Wherry (1950), and treated biosystematically by Erbe & Turner (1962), all of this reevaluated by Wherry (1966) in his treatment of the group for the Flora of Texas. In connection with a forthcoming *Atlas of the Vascular Plants of Texas* (Turner & Nichols, in prep.) I have had to evaluate the complex yet again and present here a

somewhat different interpretation of the group than that rendered in 1962, this largely due to considerable field work thereafter and thorough study of the numerous new collections assembled since. All of the herbarium specimens upon which the present study is based are housed at LL, TEX, and all have been duly annotated according to my perception of their closest relationship (*i.e.*, I did not attempt to show by symbols the intergradational specimens, so numerous their number). The following provides a means for the recognition of the typical elements of the taxa concerned; following this a brief accounting of the nomenclature and biology of each is rendered.

Key to the infraspecific taxa of *Phlox drummondii*
(All of the taxa intergrade to some extent in regions of contact, except for the isolated endemic, *P. drummondii* var. *johnstonii*, and introduced cultivar populations of var. *peregrina*)

1. Populations mostly local, highly variable, especially in flower color, varying from white to pink, to lavender and crimson; introduced, but persistent, cultivars. ....var. *peregrina*
1. Populations relatively uniform, especially in flower color (exceptional hybrid individuals of *P. drummondii* × *P. cuspidata* excluded).
    2 Corolla tubes glabrous, or if pubescent the corollas purplish-pink with well-developed white eyes and lobes 6-8 mm long; southern Texas..... var. *littoralis*
    2. Corolla tubes pubescent, the corollas highly variable but well-defined white eyes absent and lobes mostly 8-12 mm long; south-central and north-central Texas.
        3. Corollas vivid-red or crimson to deep lavender; mid-stem leaves mostly sessile or abruptly tapered at the base. .... var. *drummondii*
        3. Corollas various shades of pink or lavender; mid-stem leaves mostly gradually tapered below.
            4. Corollas with tubes mostly 18-25 mm long; plants of the southern panhandle region of Texas (Fisher, Kent, and Stonewall counties), occurring in red dune sands dominated by oak shinnery. var. *johnstonii*
            4. Corollas with tubes mostly 10-18 mm long; plants not in the southern panhandle regions of Texas.
                5. Mature pedicels mostly 2-5 mm long; central and north-central Texas. ....var. *mcallisteri*
                5. Mature pedicels mostly (4-)5-12 mm long; south-central Texas. .... var. *tharpii*

Phlox drummondii Hook. var. *drummondii*

My interpretation of this taxon is somewhat broader than that espoused by Erbe & Turner (1962) and Wherry (1967), including *Phlox drummondii* var. *goldsmithii* (Whitehouse) Erbe of the former (this also championed by Wherry 1967) and *P. drummondii* var. *wilcoxiana* Erbe (the latter also retained by Wherry). Attempts to disentangle varieties *goldsmithii* and *wilcoxiana*, either in the field and/or in the herbarium seem futile at best, although this or that population and/or assemblage of

individuals from a given region might suggest that such a segregation is warranted. The variety *drummondii*, as here interpreted, is a melange of populations, peripheral elements of which grade into closely adjacent populations of varieties *tharpii* (Whitehouse) Erbe, *mcallisteri* (Whitehouse) Shinners, and *littoralis* Cory, as might be surmized from Figure 1. Wherry (1967) largely distinguished var. *wilcoxiana* from var. *drummondii* by its bright red corollas having a "dark red eye-ring or star, the pigment persistent." I found this character to be inconsistent, both in the field and in herbaria, as did Erbe & Turner (1962) who commented upon its likely derivation through gene flow from *P. cuspidata* (*cf.* also the account of Levin 1967), or perhaps through introgression from the allopatric *P. drummondii* var. *tharpii*.

Phlox drummondii Hook. var. ***johnstonii*** (Wherry) B.L. Turner, *stat. nov.* BASIONYM: *Phlox johnstonii* Wherry, Wrightia 2:198. 1961. *Phlox drummondii* Hook. subsp. *johnstonii* (Wherry) Wherry, Sida 1:250. 1964.

Wherry, as noted in the above synonymy, reduced his initial taxon to subspecific rank under *Phlox drummondii* with the following observation (Wherry 1967): "Since this taxon differs from type-Drummondii [sic] to about the same extent as the others, it is now being classified as an additional subspecies."

In his original description, Wherry noted that the taxon was most closely related to var. *mcallisteri* and might be "considered a species, subspecies, or variety, as individually preferred." I treat the subspecies as a clustering category (*cf.* Erbe & Turner 1962) as do yet other systematists of my ilk.

Typical elements of var. *johnstonii* differ from var. *mcallisteri* in having a more open inflorescence, the flowers borne upon longer pedicels and having longer corolla tubes, the latter also emphasized by Wherry (1967). The taxon is a local endemic in the area concerned, occurring on dune-like sands dominated by dwarf oaks ("shinnery," as noted on label data of four of the five collections housed at LL, TEX).

Phlox drummondii Hook. var. *littoralis* Cory, Rhodora 39:421. 1937.
Phlox drummondii Hook. subsp. *glabriflora* Brand, 1907.
Phlox glabriflora (Brand) Whitehouse, 1935.
Phlox littoralis (Cory) Whitehouse, 1945.
Phlox glabriflora (Brand) Whitehouse subsp. *littoralis* (Cory) Wherry, 1955.
Phlox drummondii Hook. var. *glabriflora* (Brand) Erbe, 1962.

This taxon has a checkered history, as amply attested to by the account of Wherry (1967) who treated it as a subspecies of *Phlox glabriflora*, this having been treated as a variety of *P. drummondii* by Erbe & Turner (1962) and by Cory (1937), but as a species by Whitehouse (1945). As noted in the above synonymy, Brand (1907) did not account for the taxon, having little material of the typical element; most of this he subsumed under his simplistic concept of *P. drummondii* subsp. *glabriflora* (*i.e.*, specimens from southernmost Texas having glabrous corollas were given this name). If treated as a distinct species, the correct name for the taxon concerned is *P. littoralis*; if treated as a subspecies, the correct name is *P. drummondii* subsp. *glabriflora*; if treated as a variety, however, its correct name is *P. drummondii* var. *littoralis*, since

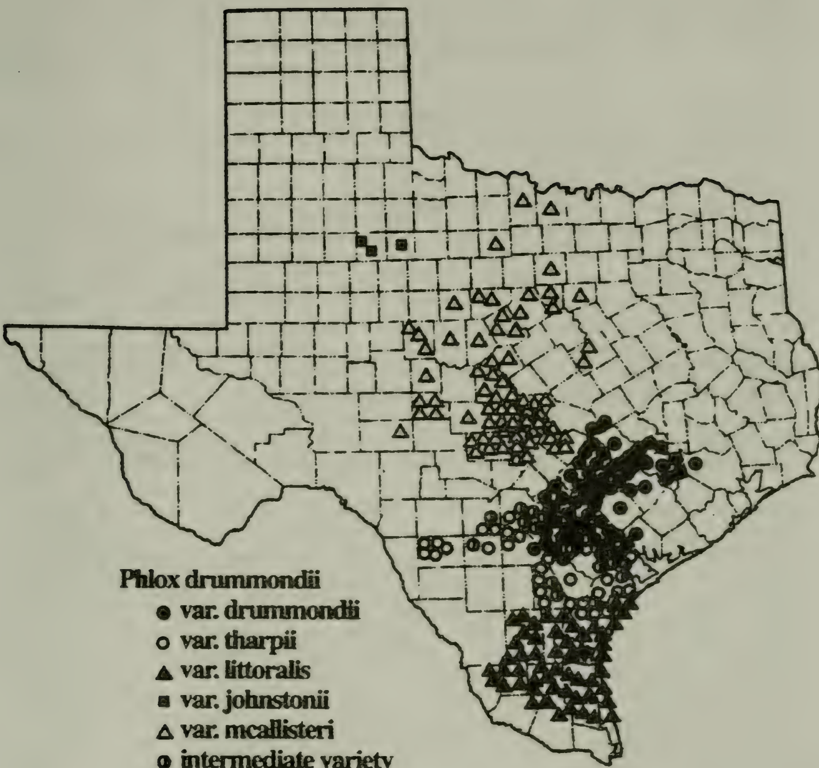

Fig. 1. Distribution of natural varieties of *Phlox drummondii*.

Fig. 2. Distribution of introduced populations of *Phlox drummondii* var. *peregrina*.

this is the earliest name at the rank concerned, the var. *glabriflora* having been proposed by Erbe in 1962. In short, if var. *littoralis* and var. *glabriflora* are treated as a single taxonomic entity, the correct name at the varietal level is var. *littoralis*; if treated as a subspecies, the correct name is var. *glabriflora*; if treated as a distinct species, the name is *P. glabriflora*.

I do not consider var. *glabriflora* to be sufficiently distinct from var. *littoralis* so as to be recognized. The latter appears to be but coastal populational forms having mostly pubescent corolla tubes, there being considerable variation in the latter character, both across the range of the taxon and along regions of contact where the typical populational elements (of var. *glabriflora*) grade into the typical populational elements of var. *littoralis*. Whitehouse (1935) recognized *Phlox glabriflora* as distinct from *P. littoralis*, noting in her justification for their recognition, that "along the boundaries [of the two species], various forms with pubescent corolla tubes show evidence of hybridization [with what, is not mentioned] and these will not be reported [upon] without further investigation." In her last treatment of the group (Whitehouse 1945), however, she retained both species, without comment, except to note that *P. littoralis* is evidently "of more recent origin than the other annuals" and that "it is found only on the beach sands, being abundant in some regions. It starts blooming early in the year, and some plants continue until late summer. The plants along the coast show little variation but on the inner boundary of their range there is some variation as well as some possible evidence of hybridization [again, with what is not mentioned]."

Erbe & Turner (1962) in their biosystematic study of the *Phlox drummondii* complex treated var. *glabriflora* and var. *littoralis* as distinct, positioning both in subsp. *glabriflora*. Field and herbarium studies since this time lead me to believe that there is little justification in their treatment either as distinct varieties or as belonging to a distinct subspecies, so completely do they intergrade across regions of near contact, presumably as a result of past gene flow between yet other elements of *P. drummondii*. Since the northern coastal dunes, to which elements of var. *littoralis* are largely confined, are relatively recent in age (formed from offshore barrier islands ca. 6000 years ago, *cf.* Miller *et al.* 1968), Whitehouse is probably correct in her assumption that the populations concerned are of very recent origin, whether out of gene flow from other elements of *P. drummondii* or by gradual selection over generations from glabrous-flowered members of the var. *littoralis* complex remains moot.

Phlox drummondii Hook. var. *mcallisteri* (Whitehouse) Shinners, Field & Lab. 19:127. 1951.
Phlox mcallisteri Whitehouse, 1945.
Phlox drummondii Hook. subsp. *mcallisteri* (Whitehouse) Wherry, 1956.

My concept of this taxon is essentially the same as that of Erbe & Turner (1962) and Wherry (1966). The variety is largely confined to sandy soils of forested or deforested areas in north-central Texas, as noted by Whitehouse (1945), who treated the taxon as specifically distinct. Wherry (1966), correctly notes that in view of its relative isolation "the paucity of morphological distinctions [between var. *mcallisteri* and yet other varieties] is surprising." In total characters, however, it most closely resembles the varieties *johnstonii* and *tharpii*. Levin & Schmidt (1985) give a detailed

analysis of a region of intergradation between var. *mcallisteri* and var. *drummondii*; whether this is due to primary intergradation or secondary intergradation (*i.e.*, hybridization) remains moot, in my opinion.

Phlox drummondii Hook. var. *tharpii* (Whitehouse) Erbe, Amer. Midl. Naturalist 67:280. 1962.
Phlox tharpii Whitehouse, 1945.
Phlox glabriflora (Brand) Whitehouse subsp. *tharpii* (Whitehouse) Wherry, 1955.

My interpretation of this taxon is about the same as that of Erbe & Turner (1962) and Wherry (1966). The latter author recognized var. *tharpii* as part of his concept of *Phlox glabriflora* in his 1955 treatment but acquiesced to the treatment of Erbe & Turner in his 1966 reevaluation of the taxon.

Phlox drummondii Hook. var. *peregrina* Shinners, Field & Lab. 19:127. 1951.

As noted by Wherry (1966) and yet others, this name has been provided for artificially established populations of various cultivars. It mostly occurs in locally bounded populations of several hundred to thousands of individuals along roadsides, these often planted by wildflower enthusiasts. Such populations also occur in yet other countries (Ali 1971), including those of tropical montane Africa, as I personally noted during my travels to this region in 1956. In Texas, the taxon is quite common, occurring as isolated, but independently established populations, over a broad region (Figure 2).

Purists might prefer to use the earliest cultivar name provided for this taxon, that being *Phlox drummondii radowtzii* Regel, first proposed in 1865, this based upon garden grown plants having rose-colored, white-striped, funnelform corollas, as noted by Whitehouse (1945). Its application to the established cultivar populations of central Texas (or elsewhere) is ill-advised, although, technically, perhaps correct. At least I like the Shinners' application on pragmatic grounds, there being few funnelform corollas seen in the Texas populations, although occasional plants with somewhat broadened tubes do occur in this or that population.

LITERATURE CITED

Ali, S.I. 1971. *Phlox*, in Polemoniaceae. *Fl. West Pakistan* 8:3.
Brand, A. 1907. *Phlox*, in Polemoniaceae. Engler's *Das Pflanzenreich* 4:250. 70-71.
Erbe, L. & B.L. Turner. 1962. A biosystematic study of the *Phlox cuspidata-Phlox drummondii* complex. Amer. Midl. Naturalist 67:257-281.
Kelly, J.P. 1915. Cultivated varieties of *Phlox drummondii*. J. New York Bot. Gard. 16:179-191.
Levin, D.A. 1967. Hybridization between annual species of *Phlox*: population structure. Amer. J. Bot. 54:1122-1130.

Levin, D.A. & K.P. Schmidt. 1985. Dynamics of a hybrid zone in *Phlox*: an experimental demographic investigation. Amer. J. Bot. 72:1404-1409.

Miller, H.E., T.J. Mabry, B.L. Turner, & W.W. Payne. 1968. Infraspecific variation of sesquiterpene lactones in *Ambrosia psilostachya* (Compositae). Amer. J. Bot. 55:316-324.

Wherry, E.T. 1955. *The Genus Phlox*. Assoc. Morris Arboretum, Philadelphia, Pennsylvania.

Wherry, E.T. 1966. *Phlox*, in Flora of Texas 1:302-321.

Whitehouse, E. 1935. Notes on Texas phloxes. Bull. Torrey Bot. Club 62:381-386.

Whitehouse, E. 1945. Annual *Phlox* species. Amer. Midl. Naturalist 34:388-401.

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TWO NEW SPECIES OF *ERIGERON* (ASTERACEAE: ASTEREAE) FROM MEXICO

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ABSTRACT

Two Mexican species of *Erigeron* are described as new to science. ***Erigeron fluens*** Nesom, *spec. nov.*, from sierran Veracruz, Hidalgo, and the Nuevo León/Tamaulipas border, is closely related to *E. karvinskianus* DC. ***Erigeron reinana*** Nesom, *spec. nov.*, from east-central Sonora, is most similar and apparently closely related to *E. coronarius* E. Greene.

KEY WORDS: *Erigeron*, Asteraceae, Astereae, taxonomy, México

Two previously undescribed species of *Erigeron* from México are brought to light in review of previously collected specimens and by recent collections from botanical exploration in Sonora.

Erigeron fluens Nesom, *spec. nov.* TYPE: MEXICO. Veracruz: Mpio. Acajetes, El Encinal, potrero, ladera de cerro, abundante en lugares despejados, 2400 m, 6 Apr 1970, *F. Ventura A. 830* (HOLOTYPE: UNAM!; Isotype: ENCB!).

Erigeronti karvinskiano DC. affinis sed differt basi non ligneo stolonibus, statura breviore, et capitulis minoribus.

Perennial herbs from a system of slender, shallow rhizomes or stolons, without a caudex, apparently forming colonies of plants interconnected by rhizomes ca. 2-10 cm long, the erect stems 5-23 cm tall, unbranched and monocephalous, eglandular, sparsely strigose with retrorsely oriented hairs ca. 0.1 mm long. Leaves basal and cauline, without axillary tufts of smaller leaves, the lower mostly 15-25 mm long, 5-11 mm wide, gradually decreasing in size and lobing up to the peduncle base, oblanceolate to obovate, narrowed to a petiolar portion 1/5-1/3 the length of the leaf, not clasping, the blades 3-lobed (rarely 5-), the terminal lobe rounded, with lanceolate

to triangular lateral lobes, less commonly entire, minutely strigose above and beneath, eglandular. Heads solitary on ebracteate peduncles (2-)3-9 cm long and 1/5-4/5 the length of the whole stem, the shorter stems appearing essentially scapose; involucres 5-7 mm wide; phyllaries linear-lanceolate, in 3-4 subequal series, very sparsely strigose to glabrate, eglandular; receptacles convex. Rays 45-60, the lamina 5-6 mm long, white, apparently neither coiling nor reflexing; disc corollas tubular-funnelform, 1.8-2.0 mm long. Cypselas ca. 1.0-1.2 mm long, oblong, sparsely strigose; pappus of 12-16 barbellate bristles, usually with a few outer setae.

Additional collections examined: MEXICO. Hidalgo: Mpio. Tenango de Doria, El Estribo (cañada N), carretera Metepec-Tenango de Doria, bosque mixto, rocas andesíticas, abundante en los lugares húmedos, 1800 m, 29 Apr 1973, *J.R. Gimate Leyva 953* (ENCB - 2 sheets). Nuevo León: Dulces Nombres, and just E of border into Tamaulipas, 24° N, 99.5-100.5° W, steep moist banks above dry stream bed, 1310 m, 25 Jun 1948, *F.G. Meyer & D.J. Rogers 2671* (MO,US).

Erigeron fluens is named for the "flowing" aspect of its low habit and thin, spreading rhizomes.

Collections of the newly recognized species all were first identified as *Erigeron karvinskianus* DC. -- the US sheet (*Meyer & Rogers 2671*) was noted by S.F. Blake (on the label) as a "form" of *E. karvinskianus*. The two entities are similar in their characteristically lobed leaves, sparse and eglandular vestiture, long-pedunculate heads, and white rays with non-reflexing, non-coiling lamina (sect. *Karvinskia* Nesom, see Nesom 1989). Plants of *E. karvinskianus*, however, characteristically produce a woody or lignescent caudex, lignescent lower stems, and range up to 1 meter in height. Stems of *E. karvinskianus* may root adventitiously at the nodes when the stems are decumbent or prostrate, but this apparently is uncommon to rare and observation of hundreds of plants collected over the entire range of the species show none with the characteristic colonial habit of *E. fluens*. Plants of *E. fluens* also are shorter (5-23 cm tall vs. mostly 20-100 cm tall) and produce smaller heads (involucres 5-7 mm wide vs. 7-9 mm wide). The Nuevo León locality of *E. fluens* lies slightly north of the northernmost populations of *E. karvinskianus* in the northeastern corner of its native range (southwestern Tamaulipas).

Erigeron reinana Nesom, *spec. nov.* TYPE: MEXICO. Sonora: Mpio. Yécora, 1.1 km N of El Llano on Mesa del Campanero, pine-oak forest, 2150 m; 28° 02′ N, 109° 01′ 30″ W; uncommon annual, 18 Sep 1999, *A.L. Reina G. 99-753* with T.R. Van Devender (HOLOTYPE: TEX).

A *Erigeronte coronario* E. Greene corollis radii laxe circinatis, corollis discii anguste tubularibus, et acheniis pappo setis plerumque carentibus differt.

Taprooted annuals, stems several from the base, 9-23 cm tall, branching above the middle, eglandular, coarsely and sparsely hirsute with thick-based hairs mostly along the ridges, the hairs on the upper portions of the stem becoming upcurved, strigose immediately beneath the heads. Leaves all cauline, narrowly oblanceolate to linear, the

lower 25-35 mm long, 3.0-3.5 mm wide, gradually reduced in size upwards to linear bracts on the peduncles, the margins and midribs coarsely ciliate with thick-based hairs. Heads on bracteate peduncles, numerous in a relatively congested capitulescence; buds apparently erect; involucres 4.5-5.0 mm wide; phyllaries linear-lanceolate, thickened to the edge, sparsely short-hirsute to hirsute-strigose, with an orange midvein, in 3-4 subequal series, the inner 3.0-3.5 mm long; receptacles low-convex. Ray flowers 40-55, the lamina 3.5-5.0 mm long, 0.4-0.6 mm wide, white, drying pinkish, without a definite colored midstripe, apparently loosely coiling. Disc corollas tubular-funnelform, orange-veined, 2 mm long, not prominently inflated above the short tube. Cypselas ca. 1.0-1.3 mm long, oblong, orange-veined, sparsely short-strigose; pappus a minutely fimbriate crown ca. 0.08 mm high, without bristles or inner florets variably with 1-3 extremely fragile, barbellate bristles.

The plant is named in honor of its collector, Ana Lilia Reina Guerrero, a botanist and ethnobotanist, who has been studying the flora of the Yécora area for the past eight years.

"Mesa del Campanero, located above the town of Yécora, is one of the higher areas in the Sierra Madre Occidental in eastern Sonora. The vegetation on top of Mesa del Campanero at 2000-2200 m elevation is a pine-oak forest dominated by *Pinus engelmannii* and *Quercus mcvaughii*. Other important trees include occasional *P. strobiformis*, *Q. arizonicus*, *Q. coccolobifolia*, and *Arbutus arizonicus* and *A. xalapensis*. *Arctostaphylos pungens* is a locally common shrub. The new species was in a disturbed area near the road that traverses the top of the Mesa" (*fide* Tom Van Devender).

Erigeron reinana is recognized by its taprooted habit, narrow, entire leaves, numerous heads on short peduncles, erect buds, and pappus a minutely fimbriate crown, without bristles or with inner florets variably with 1-3 extremely fragile, barbellate bristles. A number of characters suggest that the new species is related to *E. coronarius* E. Greene and other species of *Erigeron* sect. *Geniculactis* Nesom (Nesom 1990). These species have in common a taprooted habit, a vestiture of course hairs mostly along the cauline ridges and foliar veins, narrow, entire leaves, numerous heads on short peduncles, erect buds, orange-veined achenes, a coronate pappus, usually with bristles few in number (4-16, reduced to only a corona *in E. janivultus* Nesom; coronate but very rarely without bristles in *E. coronarius*), and they mostly occur in western continental México. In contrast to the diagnostic features of sect. *Geniculactis*, however, the ray florets of *E. reinana* are fewer (40-55 vs. 80-250), the ray lamina apparently are loosely coiling (vs. reflexing at the tube-lamina junction) and the disc corollas are narrowly tubular (vs. prominently inflated above the tube).

Only two other species besides *Erigeron reinana* in western México are taprooted and lack pappus bristles: *E. strigulosus* E. Greene (sect. *Imbarba* Nesom) and *E. versicolor* (Greenm.) Nesom (sect. *Olygotrichium* Nutt.) (Nesom 1989). The specialization in habit and reduced pappus apparently are independently derived in each of these species.

KEY TO EPAPPOSE, TAPROOTED SPECIES OF *ERIGERON* IN CHIHUAHUA AND SONORA

1. Heads 7-10 mm wide; rays 80-200, (6-)8-16 mm long; achene apex "shouldered" (incurved below pappus insertion), with thickened, white ribs........*E. strigulosus*
1. Heads 5-9 mm wide; rays 40-400, 4-6 mm long; achene apex not shouldered, with thin, orange ribs..........(2)
   2. Heads on long, ebracteate peduncles; involucres 5-9 mm wide; buds nodding; phyllaries ovate with broad, hyaline margins; rays 250-400, achenes with only a cartilaginous rim; receptacles conical..........*E. versicolor*
   2. Heads numerous on short, bracteate peduncles; involucres 4.5-5.0 mm wide; buds erect; phyllaries linear, thickened to the margins; rays 40-55; pappus coronate; receptacles low-convex..........*E. reinana*

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LITERATURE CITED

Nesom, G.L. 1989. Infrageneric taxonomy of New World *Erigeron* (Compositae: Astereae). Phytologia 67:67-93.

Nesom, G.L. 1990. Taxonomy of the *Erigeron coronarius* group of *Erigeron* sect. *Geniculactis* (Asteraceae: Astereae). Phytologia 69:237-253.

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BIOACTIVITY OF SEAWEEDS AGAINST SOIL-BORNE PLANT PATHOGENS

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ABSTRACT

Ethanolic extract of seventeen species of seaweeds were tested against juveniles of *Meloidogyne javanica.* Five seaweeds, *Sargassum binderi, Stokeyia indica, Caulerpa taxifolia, Codium iyengarii,* and *Rhizoclonium implexum* caused 100% juvenile mortality at 10 mg/mL after 48 hours. Five more seaweeds (*Padina pavonia, Spatoglossum asperum, Spatoglossum variable, Botryocladia leptopoda,* and *Solieria robusta* also caused larval mortality more than 50% at 10 mg/mL. *Stokeyia indica* and *Soliera robusta* also caused larval mortality more than 50% at the dose level of 1 mg/mL. Ethanolic extracts were also tested against root infecting fungi *Macrophomina phaseolina, Rhizoctonia solani, Fusarium solani,* and *F. oxysporum.* *Spatoglossum asperum* and *Spatoglossum variable* inhibited radial growth of *M. phaseolina, R. solani,* and *F. solani* in vitro when used at 6 mg/disc. *Stoechospermum marginatum* and *Codium iyengarii* also inhibited the growth of *F. solani* at the same concentration.

KEY WORDS: seaweeds, nematicide, fungicide

INTRODUCTION

Plant disease-causing organisms produce extensive damage to crop plants and adversely affect the agricultural economy of a country. Among the plant pathogens, soil-borne root infecting fungi [*viz., Macrophomina phaseolina* (Tassi) Goid., *Rhizoctonia solani* Kuhn, *Fusarium solani* (Mart.) Appel. & Wollenw. emend. Snyd. & Hans, and *F. oxysporum* Schlecht.] and root knot nematode (*Meliodogyne* spp.) attack roots of plants, limit nutrient uptake by the plant, and produce root rot-root knot disease complex, resulting in the death of the plant. Such conditions were found to be very common in agricultural fields of Pakistan (Ehteshamul-Haque & Ghaffar 1994;

Maqbool 1992). Seaweeds are generally used for enhancement of plant growth (Atzmon *et al.* 1994). Seaweeds are also known to reduce the fecundity of the root knot nematode on tomato (Whapham *et al.* 1994). Marine algae have been reported to possess a wide range of bioactive properties (Hoppe & Levering 1982). They showed antioxidative (Yan *et al.* 1998) and antitumor activity (Zhuang *et al.* 1995). Liquid concentrations of the brown alga *Ecklonia maxima* (Osbeck) Papenfuss significantly reduced root knot infestation and increased growth of tomato (Featomby-Smith & Standen 1983). Antimicrobial and cytotoxic activities of seaweed have been reported (Hodgson 1984; Ara *et al.* 1999). Ara *et al.* (1996a) reported nematicidal activity of some seaweeds from Pakistan. However, a detailed study on the effect of seaweeds on soil-borne root infecting fungi and root knot nematode is lacking. The present report describes in vitro bioactivity of seaweeds against the root infecting fungi *Macrophomina phaseolina, R. solani, F. solani*, and *F. oxysporum*, as well as the root knot nematode *Meloidogyne javanica* (Treub) Chitwood.

MATERIALS AND METHODS

Brown, green, and red algae [viz., *Dictyota dichotoma* (Huds.) Lamour, *Iyengaria stellata* (Borg.) Borg., *Padina pavonia* (L.) Lamour, *Sargassum binderi, Sargassum variegatum, Spatoglossum asperum* J. Ag., *Spatoglossum variable* Fig. & D.E. Notar., *Stoechospermum marginatum* (C. Ag.) Kutz., *Stokeyia indica* Thivy & Doshi, (brown); *Caulerpa racemosa* (Forsk.) J. Ag., *Caulerpa taxifolia* (Vahl.) C. Ag., *Codium iyengarii* Borg., *Rhizoclonium implexum* (Dillw.) Kutz., *Ulva lactuca* L., (green); *Botryocladia leptopoda* (J. Ag.) Kylin, *Halymenia porphroides* C. Ag., *Sciania indica*, and *Solieria robusta* (Greville) Kylin (red)] were collected from Buleji Beach, Paradise Point, and Pacha Beach, Karachi, Pakistan in different seasons at low tide. Different species of seaweeds exposed on sand and rocks were collected in plastic bags and brought to the laboratory. Each species of seaweed was washed under tap water and dried under shade. The seaweeds were then powdered in an electric blander and stored in polyethylene bags at room temperature until used.

Dry powder of seaweeds (500 g each) were extracted three times with ethanol (4× volume) for one week. Extracts were pooled, filtered through cotton wool and concentrated to dryness on rotary vacuum evaporator and weighed. Antimicrobial activity of ethanolic extract of seaweeds was determined by the method used by Ahmad *et al.* (1986). The method was modified using a dilution of 200 mg/mL of crude extract of seaweed prepared in ethanol. The sterilized thick filter paper discs (5 mm) were impregnated with these dilutions at 2, 4, and 6 mg/disc and dried. Discs were placed at different peripheral positions of petri dishes containing Czepak's Dox agar (pH 7.2). Discs impregnated with only ethanol served as negative control, while benomyl (10 yg/disc) served as positive control. A 5 mm disc of actively growing culture of test fungi (*Macrophomina phaseolina, Rhizoctonia solani, Fusarium solani*, and *F. oxysporum*) was inoculated in the center of the petri dishes. Each treatment was replicated three times and plates were incubated at 28° C. Zones of inhibition produced were recorded daily.

Table 1. *In vitro* growth inhibition of *Macrophomina phaseolina*, *Rhizoctonia solani*, *Fusarium solani*, and *F. oxysporum* by the ethanolic extract of seaweed.

	Zone of inhibition (mm)			
Seaweeds	*M. phaseolina*	*R. solani*	*F. solani*	*F. oxysporum*
Control	0	0	0	0
Standard (benomyle)				
10 yg/disc	13	7	14	15
PHAEOPHYTA				
Dictyota dichotoma				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Iyengaria stellata				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Padina pavonia				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Sargassum binderi				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Sargassum variegatum				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Spatoglossum asperum				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	2	2	5	0
Spatoglossum variabile				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	*	2	5	0
Stoechospermum marginatum				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	3.5	0

Table 1. (continued)

	Zone of inhibition (mm)			
Seaweeds	*M. phaseolina*	*R. solani*	*F. solani*	*F. oxysporum*
CHLOROPHYTA				
Caulerpa racemosa				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Caulerpa taxifolia				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Codium iyengarii				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	2	0
Rhizoclonium implexum				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
Ulva lactuca				
2 mg	0	0	0	0
4 mg	0	0	0	0
6 mg	0	0	0	0
RHODOPHYTA				
Botryocladia leptopoda				
2 mg	0	0	0	NT
4 mg	0	0	0	NT
6 mg	0	0	0	NT
Halymenia porphroides				
2 mg	0	0	NT	0
4 mg	0	0	NT	0
6 mg	0	0	NT	0
Sciania indica				
2 mg	0	0	0	NT
4 mg	0	0	0	NT
6 mg	0	0	0	NT
Solieria robusta				
2 mg	0	0	0	NT
4 mg	0	0	0	NT
6 mg	0	0	0	NT

*inhibited, but no zone was produced
NT=not tested

Table 2. *In vitro* mortality of *Meloidogyne javanica* juveniles at different concentration of ethanolic extract of seaweeds after 48 hours.

	Juveniles mortality (%) at various concentrations (mg/mL)			
Seaweeds	0.01	0.1	1.0	10.0
Control	0	0	0	0
PHAEOPHYTA				
Dictyota dichotoma	0	0	6	10
Iyengaria stellata	4	3	7	36
Padina pavonia	3	0	27	71
Sargassum binderi	2	6	18	100
Sargassum variegatum	3	10	60	100
Spatoglossum asperum	0	0	16	53
Spatoglossum variabile	0	29	33	77
Stoechospermum marginatum	3	12	17	83
Stokeyia indica	0	3	75	100
CHLOROPHYTA				
Caulerpa racemosa	0	0	21	30
Caulerpa taxifolia	0	3	5	100
Codium iyengarii	3	24	43	100
Rhizoclonium implexum	5	7	13	100
Ulva lactuca	0	6	14	28
RHODOPHYTA				
Botryocladia leptopoda	3	4	7	50
Halymenia porphroides	6	12	17	20
Sciania indica	8	8	11	26
Solieria robusta	0	44	56	98

$LSD_{0.05}$ seaweed=6.4, concentration=2.9

The nematicidal activity of seaweed was determined by the method used by Ara *et al.* (1997) using 0.01, 0.1, 1.0, and 10.0 mg/mL concentrations of seaweed extract were prepared in ethanol. Two mL of each concentration was transferred to a small watch glass and left for 48 hours to evaporate the organic solvent. Twenty hand-picked second stage juveniles of *Meloidogyne javanica* were placed in each glass, containing 2 mL glass distilled water. A watch glass without extract served as control. Each treatment was replicated three times. The number of juveniles that were killed after 48 hours were recorded using a stereomicroscope. Data were subjected to analysis of variance (ANOVA) followed by least significant difference (LSD) (Gomez & Gomez 1984).

RESULTS AND DISCUSSION

Of the seventeen seaweed species tested against root infecting fungi, *Spatoglossum asperum* and *Spatoglossum variable* inhibited the growth of *Macrophomina phaseolina, Rhizoctonia solani,* and *Fusarium solani*, at 6 mg/disc. *Spatoglossum asperum* produced 2, 2, and 5 mm zones against *M. phaseolina, R. solani,* and *F. solani* respectively, while *Spatoglossum variable* produced 2 and 5 mm zones against *R. solani* and *F. solani* respectively. *Stoechospermum marginatum* and *Codium iyengarii* produced 3.5 and 2 mm zones against *F. solani* respectively (Table 1).

Of the seaweed species tested *Sargassum binderi, Stokeyia indica, Caulerpa taxifolia, Codium iyengarii,* and *Rhizoclonium implexum* caused 100% mortality of juveniles after 48 hours at the concentration of 10 mg/mL, whereas *Padina pavonia, Spatoglossum asperum, Spatoglossum variable, Stoechospermum marginatum, Botryocladia leptopoda, J. capillacea,* and *Solieria robusta* showed more than 50% mortality at the dose level of 1 mg/mL (Table 2).

In the present study, some seaweeds showed nematicidal and fungicidal activity. Growth inhibition of several bacteria and fungi by seaweed has been reported (Shyamali *et al.* 1982). Out of 30 seaweeds belonging to brown, red, and green algae tested, most of which showed antibacterial and hemolytic activity (Rao *et al.* 1991). Febles *et al.* (1995) reported antimicrobial activity of Canary Island species of Phaeophyta and Chlorophyta. Shaikh *et al.* (1990) isolated four diterpenoides from *Stoechospermum marginatum* which exhibited antibacterial and antifungal activities. There are reports that seaweed extracts derived from *Ascophyllum nodosum* (Linnaeus) Le Jolis reduced *Radopholus similis* infection on citrus (Tarjan 1977). Soil amendment with brown seaweeds, *Stoechospermum marginatum* and *Sargassum tenerrimum* significantly reduced gall formation on mungbean plants caused by *Meloidogyne javanica*, and enhanced plant growth (Siddiqui *et al.* 1998). Ara *et al.* (1996b) reported that soil amendment with *Sargassum* species significantly reduced infection of *Macrophomina phaseolina, Rhizoctonia solani*, and *Fusarium solani* on sunflower. Use of brown seaweed *Stoechospermum marginatum* significantly reduced gall formation on okra caused by *Meloidogyne javanica* (Ehteshamul-Haque *et al.* 1996). In the present study, *Spatoglossum asperum* showed growth inhibition of *Macrophomina phaseolina, Rhizoctonia solani, Fusarium solani* and larval mortality of *Meloidogyne javanica*. *Spatoglossum asperum* could be exploited for the isolation of nematicidal and fungicidal compounds. *Stokeyia indica* and *Solieria robusta* also

showed significant nematicidal activity at 1 mg/mL and could also be exploited for the isolation of nematicidal compounds. Seaweeds which showed promising results could also be used as an organic amendment for the control of root infecting fungi and root knot nematode which will result in increased crop productivity.

ACKNOWLEDGMENTS

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LITERATURE CITED

Ara, J., V. Sultana, S. Ehteshamul-Haque, R. Qasim, & V.U. Ahmad. 1999. Cytotoxic activity of marine macro-algae on *Artemia salina*. Phytother. Res. 13:304-307.

Ara, J., S. Ehteshamul-Haque, V. Sultana, A. Ghaffar, & R. Qasim. 1997. Use of *Sargassum* species for the control of *Meloidogyne javanica* in okra. Nematol. Medit. 25:125-128.

Ara, J., S. Ehteshamul-Haque, V. Sultana, R. Qasim, & A. Ghaffar. 1996a. Nematicidal activity of seaweeds against *Meloidogyne javanica* root knot nematode. Pak. J. Nematol. 14:129-131.

Ara, J., S. Ehteshamul-Haque, V. Sultana, R. Qasim, & A. Ghaffar. 1996b. Effect of *Sargassum* seaweed and microbial antagonists in the control of root rot disease of sunflower. Pak. J. Bot. 28:221-226.

Ahmad, A., K.A. Khan, V.U. Ahmad, & S. Qazi. 1986. Antimicrobial activity of juliflorine isolated from *Prosopsis juliflora*. Planta Med. 52:285-288.

Atzmon, N., J.V. Staden, & S.J. Van. 1994. The effect of seaweed concentration on growth of *Pinus pinea* seedlings. New Forests 8:279-288.

Ehteshamul-Haque, S., M. Abid, V. Sultana, J. Ara, & A. Ghaffar. 1996. Use of organic amendments on the efficacy of biocontrol agents in the control of root rot and root knot disease complex of okra. Nematol. Medit. 24:13-16.

Ehteshamul-Haque, S. & A. Ghaffar. 1994. New records of root infecting fungi from Pakistan. Pak. J. Phytopath. 6:50-57.

Featomby-Smith, B.C. & V. Standen. 1983. The effect of seaweed concentration on the growth of tomato plants in nematode infested soil. Scientia Horticulture 20:137-146.

Febles, C.I., A. Arias, A. Hardisson, & A.S. Lopez. 1995. Antimicrobial activity of extracts from Canary species of Phaeophyta and Chlorophyta. Phytother. Res. 9:385-387.

Gomez, K.A. & A.A. Gomez. 1984. *Statistical Procedures for Agricultural Research*, 2nd ed. Wiley, New York, New York. 680 pp.

Hodgson, L.M. 1984. Antimicrobial and antineoplastic activity in some South Florida seaweeds. Botanica Mar. 29:387-390.

Hoppe, H.A. & Levring. 1982. *Marine Algae in Pharmaceutical Sciences*. Vol. 2. Walter de Gruyter, Berlin, Germany. 309 pp.

Maqbool, M. 1992. *Distribution and Host Association of Plant Parasitic Nematodes in Pakistan*. University of Karachi, Karachi, Pakistan.

Rao, D.S., S. Girijavallabhan, S. Muthusamy, V. Chandrika, C.P. Gopinathan, S. Kalimuthu, & M. Najmuddin. 1991. Bioactivity in marine algae. *In*: M. Thompson, R. Sarojini, & R. Nagabhushanam (eds.). *Bioactive Compounds from Marine Organisms*. pp. 373-377. Oxford & IBH Publishing Co., Pvt. Ltd. New Delhi, India.

Shaikh, W., M. Shameel, A. Hayee-Memon, K. Usmanghani, S. Bano, & U.V. Ahmad. 1990. Isolation and characterization of chemical constituents of *Stoechospermum marginatum* (Dictyotales, Phaeophyta) and their antimicrobial activity. Pak. J. Pharm. Sci. 3:1-9.

Shyamali, S.M., S.K. De Silva, T. Gamage, & N.S. Kumar. 1982. Anti-bacterial activity of extracts from the brown seaweed *Stoechospermum marginatum*. Phytochemistry 21:944-945.

Siddiqui, I.A., S. Ehteshamul-Haque, M.J. Zaki, & A. Ghaffar. 1998. Effect of brown seaweeds (*Stoechospermum marginatum* and *Sargassum tenerrimum*) and rhizobia in the control of root knot disease and growth of mungbean. Pak. J. Nematol. 16:145-149.

Tarjan, A.C. 1977. Kelp derivatives for nematode infected citrus trees. J. Nematol 9:287 (Abstr.).

Whapham, C.A., T. Jenkins, G. Blunden, & S.D. Hankins. 1994. The role of seaweed extract, *Ascophyllum nodosum* in the reduction of fecundity of *Meloidogyne javanica*. Appl. Fund. Nematol. 17:181-183.

Yan, Y., T. Nagata, & Y. Fan. 1998. Antioxidative activities in some common seaweeds. Plant Foods Human Nutr. 52:253-262.

Zhuang, C., H. Itoh, T. Mizuno, & H. Ito. 1995. Antitumor active fucoidan from the brown seaweed, umitoranoo (*Sargassum thunbergii*). Bio. Sci. Biotechnol. Biochem. 59:563-567.

Phytologia (October 1998) 85(4):300-302.

TWO NEW COMBINATIONS IN FLORIDA SELAGINELLAS

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ABSTRACT

New combinations at the varietal level are made for two Florida *Selaginella* species.

KEY WORDS: *Selaginella*, Selaginellaceae, Florida, nomenclature

A review of certain *Selaginella* specimens for volume one of the Flora of Florida (Wunderlin & Hansen, in press) has revealed the need for two new combinations.

Selaginella armata Baker var. ***eatonii*** (Hieronymus *ex* Small) B.F. Hansen & Wunderlin, *comb. nov.* BASIONYM: *Selaginella eatonii* Hieronymus *ex* Small, *Ferns Trop. Florida* 67. 1918. *Diplostachyum eatonii* (Hieronymus *ex* Small) Small, *Ferns S.E. States* 422. 1938. TYPE: U.S.A. Florida: Miami-Dade Co.: about lime-sinks, border of Everglades, Black Point Creek, 13 Nov 1903, *Eaton 265* (LECTOTYPE: NY!; Isolectotypes: US,USF!). Lectotypified by Buck, Amer. Fern J. 68:34. 1978.

When Alston (1952) revised the West Indian species of *Selaginella*, he placed the Florida species *S. eatonii* Hieronymus *ex* Small in the synonymy of *S. armata* Baker. This was followed by Long & Lakela (1970) and Lakela & Long (1976). Buck (1978) recognized this taxon at the species level, pointing out that Alston had mistakenly placed *S. eatonii* in the synonymy of *S. armata*, while it is actually conspecific with *S. bracei* Hieronymus *ex* O.C. Schmidt of the Bahamas and Cuba. *Selaginella eatonii*, an earlier name than *S. bracei*, was separated from *S. armata* by Buck on several anatomical (*e.g.*, stomatal arrangement) and morphological characters, the most consistent and readily observed being differences in the leaf margin. *Selaginella armata* has evident hyaline leaf margins that are ciliate, especially at the base, while the leaves of *S. eatonii* have much less evident hyaline margins that are serrate. These characters hold up well, even in the material from western Cuba, where *S. eatonii* is sympatric with *S. armata* in the Pinar del Río and La Habana provinces. However, we feel that the characters are so minor and the two taxa so

obviously closely related, that the best disposition for practicality and consistency is at the varietal level. The best classification of other Caribbean forms of *S. armata*, especially robust specimens from Hispaniola, is yet to be determined by *Selaginella* workers.

Material has been seen of *Selaginella armata* var. *armata* from Puerto Rico, Hispaniola, Jamaica, and western Cuba (Pinar del Río, La Habana), and of *S. armata* var. *eatonii* from western Cuba (Matanzas, La Habana, Pinar del Río), Florida (Miami-Dade Co.), and the Bahama Islands (Andros, Abaco, Grand Bahama).

Selaginella apoda (Linnaeus) Spring var. ***ludoviciana*** (A. Braun) B.F. Hansen & Wunderlin, *comb. nov.* BASIONYM: *Lycopodium ludovicianum* A. Braun, *Index Sem. Hort. Bot. Berol.* 1857, App. 12. 1858. *Selaginella ludoviciana* (A. Braun) A. Braun, Ann. Sci. Nat. Bot., ser. 4. 13:58. 1860. *Lycopodioides ludoviciana* (A. Braun) Kuntze, *Revis. Gen. Pl.* 2:826. 1891. *Diplostachyum ludovicianum* (A. Braun) Small, *Ferns S.E. States* 422. 1938. TYPE: U.S.A. Louisiana: type collection unknown, to be sought at B.

The situation here is very much like that above, because Somers & Buck (1975) and Buck & Lucansky (1976) have analyzed the variation between *Selaginella apoda* (Linnaeus) Spring and *S. ludoviciana* (A. Braun) A. Braun, again separating the two taxa by anatomical and leaf margin characters. The main distinction is that the leaves of *S. ludoviciana* have an easily visible hyaline margin with 3-5 rows of transparent cells, while those of *S. apoda* are green to the margin or very near it (0-2 rows of transparent cells). Clewell (1985) considered the two conspecific, while Wunderlin (1998) treated them as distinct, as did Valdespino (1993). Once again, the two taxa are so obviously close that disposition at the varietal level seems best.

Selaginella apoda var. *apoda* occurs from Maine south to central Florida (Highlands Co.), west to Oklahoma and Texas and also in México (Chihuahua south to Chiapas), while *S. apoda* var. *ludoviciana* is found only on the Gulf Coastal Plain, in southwestern Georgia, northern Florida (south to Citrus Co.), southeastern Alabama, southern Mississippi, and southeastern Louisiana.

LITERATURE CITED

Alston, A.H.G. 1952. A revision of the West Indian species of *Selaginella*. Bull. Brit. Mus. (Nat. Hist.), Bot. 1:27-47.

Buck, W.R. 1978. The taxonomic status of *Selaginella eatonii*. Amer. Fern J. 68:33-36.

Buck, W.R. & T.W. Lucansky. 1976. An anatomical and morphological comparison of *Selaginella apoda* and *Selaginella ludoviciana*. Bull. Torrey Bot. Club 103:9-16.

Clewell, A.F. 1985. *Guide to the Vascular Plants of the Florida Panhandle*. Florida State University Press, University Presses of Florida, Tallahassee, Florida.

Lakela, O. & R.W. Long. 1976. *Ferns of Florida*. Banyan Books, Miami, Florida.

Long, R.W. & O. Lakela. 1971. *A Flora of Tropical Florida.* University of Miami Press, Miami, Florida.

Somers, P. & W.R. Buck. 1975. *Selaginella ludoviciana, S. apoda* and their hybrids in the southeastern United States. Amer, Fern J. 65:76-82.

Valdespino, I.A. 1993. Selaginellaceae. *In*: Flora of North America Editorial Committee. *Flora of North America North of Mexico.* 2:38-63. Oxford University Press, New York, New York.

Wunderlin, R.P. 1998. *Guide to the Vascular Plants of Florida.* University Press of Florida, Gainesville, Florida.

Phytologia (October 1998) 85(4):303-305.

BOOKS RECEIVED

A Revision of Aconitum Subgenus Aconitum (Ranunculaceae) of East Asia. Yuichi Kadota. Sanwa Shoyaku Company, Ltd., 6-1, Hirade Kogyo Danchi, Utsunomiya, Tochigi 321, Japan. 1987. xviii. 249 pp., 65 plates. Price unknown. No ISBN (hardcover).

Based on a Ph.D. dissertation, this book summarizes information on the subgenus *Aconitum* of this exceedingly large and complex genus. Keys are provided to identify sections, series, species, and infraspecific taxa. Descriptions, range maps, and lists of specimens examined are included for each taxon. In addition to the detailed and comprehensive descriptions and taxonomic treatments, two color plates, 65 black and white plates, and numerous line drawings are included in the book. Summaries of the methods and techniques used will be of great value to future workers on *Aconitum* and other genera. In addition to the morphological and classical taxonomic data, careful consideration of chromosomes and hybridization are also contained within this work.

BIOTAM Investigación Científica y Tecnológica, vol. 1, number 1. Adelina Nuñez Rios (ed.). Instituto de Ecología y Alimentos de la Universidad Autónoma de Tamaulipas, Boulevard Adolfo López Mateos Nte. 928, C.P. 87040, Cd. Victoria, Tamaulipas, México. Abr-Jun 1989. 80 pp. $7000 Nuevos Pesos. ISSN 0187-8476.

This periodical has been instituted to present scientific articles and commentaries on ecology and agriculture. This inaugural issue contains eleven articles. Two of the articles are commentaries, one on the state of nutrition in México, the other on the Biosphere Reserves of México. Six other articles are ecological pieces, the majority of them dealing with some aspect of the El Cielo Biosphere Reserve. The remaining three articles discuss agricultural topics.

BIOTAM Investigación Científica y Tecnológica, vol. 2, number 2. Adelina Nuñez Rios (ed.). Instituto de Ecología y Alimentos de la Universidad Autónoma de Tamaulipas, Boulevard Adolfo López Mateos Nte. 928, C.P. 87040, Cd. Victoria, Tamaulipas, México. Ago-Nov 1990. 64 pp. $12000 Nuevos Pesos. ISSN 0187-8476.

Articles in this issue include a discussion of the management plan for the El Cielo Biosphere Reserve, seasonal variation in the tissues of fish species, water birds of the Laguna Madre, taxonomy and behavior of Mexican locusts, two papers on wasp diversity in southern Tamaulipas, and a list and discussion of rare plants in Tamaulipas.

Ironwood: An Ecological and Cultural Keystone of the Sonoran Desert. Gary Paul Nabhan & John L. Carr (eds.). Occasional Paper No. 1, Occasional Papers in Conservation Biology, Conservation International, Department of Conservation Biology, 1015 18th Street, NW, Suite 1000, Washington, DC. 20036. 1994. iv. 92 pp. Available from The University of Chicago Press, 5801 South Ellis Avenue, Chicago, Illinois 60637. $10.95 ISBN 1-881173-07-0 (paper).

Topics treated in the four chapters of this booklet include general ironwood (*Olneya tesota* A. Gray) ecology, ironwood as a modifier of habitat for other species, boundary effects on cacti and nurse plants, and ironwood used in art (primarily carvings).

Orchid Biology, Reviews and Perspectives, VI. Joseph Arditti (ed.). John Wiley, Inc., 605 Third Avenue, New York, New York 10158. 1994. xviii. 610 pp. $115.00 ISBN 0-471-54907-x (hardcover).

The current volume in this series includes seven chapters. These chapters cover topics as diverse as history of orchids in Europe, orchid floral physiology, interactions between orchids and ants, fly pollination in orchids, and cut flowers production of orchids. In addition to the seven chapters, an extensive appendix is included that summarizes orchid pests.

Seaweed Ecology and Physiology. Christopher S. Lobban & Paul J. Harrison. Cambridge University Press, 40 West 20th Street, New York, New York 10011-4211. 1994. xii. 366 pp. $69.95 ISBN 0-521-40334-0 (hardcover).

In addition to the text written by the authors, other individuals have contributed smaller segments of this book. The book begins with an introductory chapter on seaweeds, their growth and environment. A chapter on seaweed communities is followed by another chapter treating more complex ecological relationships. The next five chapters summarize various (light, nutrients, temperature/salinity, water motion, and pollution) impacts on seaweed growth and reproduction. A final chapter on cultivation, harvesting,

and uses of seaweeds is followed by an appendix comprising a taxonomic classification of seaweeds included in the text.

The Genus Mikania (Compositae - Eupatorieae) in Mexico. Walter C. Holmes. SIDA, Botanical Miscellany, No. 5, Botanical Research Institute of Texas Herbarium, Southern Methodist University, Dallas, Texas 75275. 1990. iv. 45 pp. Price unknown. ISSN 0883-1475 (paper).

Following the key to species, descriptions are included for each of the sixteen species recognized from México. The descriptions include nomenclatural summaries, line drawings, specimen lists, range maps, and commentaries on close relatives and other interesting information about the species. This will be a very useful book for anyone studying *Mikania* in México.

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NEW NAMES IN THIS ISSUE OF PHYTOLOGIA

As a result of the International Botanical Congress in Tokyo in 1993, the International Association of Plant Taxonomy has been tasked with exploring the feasibility of registration of plant and fungi names. In accordance with terms of the pilot implementation of the registration concept, new names and combinations produced in this issue of PHYTOLOGIA are listed below.

New name or combination	Page Number
Solanum ortegae C.M. Ochoa	271
Pappochroma bellidioides (Hook. *f.*) Nesom	277
Pappochroma nitidum (S.J. Forbes) Nesom	278
Pappochroma pappocromum (Labill.) Nesom	278
Pappochroma paludicola (S.J. Forbes) Nesom	278
Pappochroma setosum (Benth.) Nesom	278
Pappochroma stellatum (Hook. *f.*) Nesom	278
Pappochroma trigonum (S.J. Forbes & D.J. Morris) Nesom	279
Phlox drummondii Hook. var. ***johnstonii*** (Wherry) B.L. Turner	282
Erigeron fluens Nesom	288
Erigeron reinana Nesom	289
Selaginella armata Baker var. ***eatonii*** (Hieronymus ***ex*** Small) B.F. Hansen & Wunderlin	300
Selaginella apoda (Linnaeus) Spring var. ***ludoviciana*** (A. Braun) B.F. Hansen & Wunderlin	301

Information for Authors

Articles from botanical systematics and ecology, including biographical sketches, critical reviews, and summaries of literature will be considered for publication in PHYTOLOGIA. Manuscripts may be submitted either on computer diskette, or as clean typescript. Diskettes will be returned to authors after action has been taken on the manuscript. Diskettes may be 5.25" or 3.5" and may be written in any IBM or Macintosh compatible format. Typescript manuscripts should be single spaced and will be read into the computer using a scanner. The scanner will read standard type fonts but will not read dot matrix print. Manuscripts submitted in dot matrix print cannot be accepted. Use underscore (not italics) for scientific names. Language of manuscripts may be either English or Spanish. Figures will be reduced to fit within limits of text pages. Therefore, figures should be submitted with internal scales. Legends for figures should be included in figures whenever possible. Each manuscript should have an abstract and key word list. Specimen citations should be consistent throughout the manuscript. Serial titles should be cited with standard abbreviations. References cited only as part of nomenclatural summaries should not appear in Literature Cited. Nomenclatural work should include one paragraph per basionym and must provide proper (as defined by the current *International Code of Botanical Nomenclature*) citation of sources of epithets and combinations.

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